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## PATENT SPECIFICATION



Application Date: Feb. 10, 1933. No. 4197/33.

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Complete not Accepted.

## COMPLETE SPECIFICATION.

## Improvements in or relating to Ventilating Apparatus.

We, ERCOLE MARELLI & C.S.A., an Italian Company, of Corso Venezia 22, Milan, Italy, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to ventilating apparatus and more particularly to such apparatus for use in ventilating tramways, railway coaches and the like but is applicable for other purposes.

The chief object of the present invention is to provide an improved apparatus and particularly an improved form of fan blade for the purpose of obtaining a more efficient ventilating action.

According to the present invention the ventilating apparatus includes a fan blade which is so constructed and arranged as to cause a gaseous medium to be expelled with a centrifugal action at the periphery of the fan blade and to provide a suction effect between the periphery and centre. The fan blade may conveniently comprise a plate provided near to its periphery with a series of radial vanes arranged at right angles to the surface of the said plate; the said vanes being provided with projecting portions disposed between the centre of the fan blade and the periphery thereof which projecting portions are preferably curved to one side of the plane containing the major portions of the said vanes. The aforesaid plate is preferably provided with an annular projection of V-shape in cross section, the said vanes being preferably disposed on the surface of the said annular projection remote from the centre of the blade. The apparatus according to the invention may be employed for circulating air from the inside to the outside of for example, a tramway or railway carriage or the like the curved projecting portions of the vanes causing a suction effect in the air inside the carriage, the air so drawn into the blade being expelled

[Price 1/-]

centrifugally from the periphery of the fan blade to the outside of the carriage. Where the apparatus is intended to be employed in tropical countries it may be desirable to cause a current of air to flow from the outside of a railway coach to the inside. In such a construction the aforesaid curved portions of the vanes may be arranged on the upper side of the blade and the lower portions of the vanes may be provided with other projecting portions curved in an opposite direction to the curved portions on the upper ends of the said vanes these last mentioned curved portions serving to produce a propulsive action on the air downwardly as would be obtained with a propeller fan in addition to the centrifugal action of the air expelled at the periphery of the fan blade. A suitable deflector plate may be employed in connection with the latter arrangement and stationary vanes may be employed for the purpose of changing the circular movement of the air expelled centrifugally into a radial movement.

In order that the said invention may be clearly understood and readily carried into effect the same will now be more fully described with reference to the accompanying drawings, in which:—

Figure 1 is a partial vertical section of a ventilating apparatus according to the invention for causing a circulation of air from the inside of a railway coach or the like to the outside;

Figure 2 is a plan view of Figure 1;

Figure 3 is an underneath plan view of the blade shown in Figure 1;

Figure 4 is a side elevation of the blade shown in Figure 3 partly in section;

Figure 5 is a side elevation of a vane employed in the blade shown in Figures 1, 3 and 4;

Figure 6 is an end elevation of the vane shown in Figure 5 looking from the left hand side of latter Figure;

Figure 7 is a plan view of the vane shown in Figure 5;

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419,440

Figure 8 is a side elevation partly in section of another construction of apparatus according to the invention mainly for the purpose of causing a circulation of air from the outside of the railway coach to the inside;

Figure 9 is an underneath plan view of Figure 8 with a part of the casing broken away;

Figure 10 is a sectional view of the blade employed in the apparatus shown in Figures 8 and 9;

Figure 11 is a plan view of Figure 10; Figure 12 is a vertical section taken along the line 12—12 of Figure 10;

Figure 13 is a section through a vane of the blade taken along the line 13—13 of Figure 10;

Figure 14 is a cross sectional view of a casing enclosing the lower portion of the apparatus shown in Figures 8 and 9;

Figure 15 is a plan view of Figure 14;

Figure 16 is a cross section through a stationary vane taken along the line 16—16 of Figure 14; and

Figure 17 is a cross sectional view of a stationary vane taken along the line 17—17 of Figure 14.

Referring now more particularly to the construction of the invention illustrated in Figures 1 to 7, the apparatus generally comprises a fan blade 18 which in the example illustrated is adapted to be rotated by an electric motor 19 supported in an aperture in for example, the roof 20 of a railway coach, by brackets 21. The lower portion of the motor is enclosed by a suitably designed apertured closure member 22 through which air is drawn from the inside of the railway coach and expelled through openings in an upper closure member 23 and in which the fan blade 18 as shown in Figure 1 is mainly arranged. The fan blade 18 comprises as illustrated in Figure 4, a plate 24 having an annular depression 25 of V-shape in cross section disposed between the centre of the said plate and the periphery thereof. Arranged on the outer side of the surface 25<sup>a</sup> of the depression 25 is a plurality of vanes 26. These vanes 26 are provided with downwardly projecting portions 27 which are curved outwardly from the plane containing the major portion of the vanes as shown in Figure 6. The vertical edges 28 of the vanes are also curved as shown in Figures 6 and 7. The vanes 26 are secured to the plate 24 in any suitable manner and are also secured to a spacing and retaining ring which also serves as a separator-diffuser. Upon rotation of the vanes a suction effect is created due to the curved projections 27 of the vanes 26 and the air so impelled is discharged at the periphery of the

blade in a centrifugal manner the air so discharged passing into the casing 23 from which it passes to atmosphere through openings 30 in the casing 23 which openings are protected by louvres 31 to prevent the ingress of water. The bottom 32 of the casing 23 is provided with an upstanding flange 33 surrounding the aperture in the roof 20 of the coach or the like the casing 23 being secured in any suitable manner as by bolts to the sleeve 34.

The apparatus described thus provides a ventilating apparatus which is so constructed as to create a strong current of air from the interior to the exterior of the vehicle the construction of the blade 18 being such that the outer part thereof functions as a centrifugal fan whilst the lower portion of the blade on the suction side functions as an ordinary screw fan.

Where the apparatus is intended for circulating air from the outside for example, of a railway coach to the inside as would be desirable in tropical countries the blade shown in Figures 1 to 6 is inverted and is provided with additional curved portions for the purpose of promoting a current of air in a substantially axial direction. As shown in Figures 8 and 9 the apparatus is mounted in a hood 35 for example on a railway coach and in this example the fan blade 36 is rotated by an electric motor 37 supported by brackets 38 one of which is shown in Figure 8. The inlet or suction side of the apparatus is surrounded by a sleeve 39 and is covered by conical shaped hood 40. The fan blade 36 comprises a plate 41 as shown in detail in Figure 10 having an annular raised portion 42 of V-shape in cross section. The vanes 43 of the blade are mounted on the outer surface of the raised portion 42 of the blade and each vane is provided at its upper end with a curved portion 44 and at its lower end with another portion 45 curved in an opposite direction to the portions 44. The outer edges of the vanes 43 are also curved at 46. The vanes 43 are held in spaced relationship by and are secured to a retaining ring 47. The curved portions 44 of the vanes create a suction effect on the upper surface of the blade as viewed in Figure 8 and cause a current of air to be circulated through the hood 40 and to be expelled centrifugally at the periphery of the fan blade as indicated by the arrows in Figure 8. The curved lower portions of the vanes serve to create a propulsive action of air downwardly as would be obtained with a propeller fan. The part of the apparatus on the inside of the coach is enclosed by a casing 48 suitably apertured to permit air to be

419,440

3

forced therethrough into the interior of the vehicle. With a view to changing the circular motion of the vortex of air as expelled by the periphery of the fan blade to a radial motion a series of stationary vanes 49 are provided around the circumference of the casing 48. The shape of these vanes is shown more particularly in Figures 14, 15, 16 and 17. It will be observed from Figures 15 and 17 that the vanes 49 are pointed and are curved in a direction opposite to the direction in which the fan blade rotates. These vanes as aforesaid serve to convert the centrifugal action of air into a radial one and cause the air to be expelled through the casing 48 radially at a plurality of points through outlet apertures 50 in the vertical wall of the casing 48. The air after passing through the said apertures 50 impinges upon a deflector plate 51 of conical form as shown in Figure 8 which directs the air in the desired direction according to the cone angle of the said deflector plate.

It will be understood that the invention is not to be limited to the above details of construction as these may be varied as desired. For example instead of driving the fan blades by electric motors as shown they may be driven by other suitable means.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. Ventilating apparatus, including a fan blade, or a fan blade for use with such apparatus which is so constructed and arranged as to cause a gaseous medium to be expelled with a centrifugal action at the periphery of the fan blade, and to provide a suction effect between the periphery and the centre of the fan blade.

2. Ventilating apparatus, including a fan blade, or a fan blade for use with such apparatus as in claim 1, which is so constructed and arranged as to provide in addition a propulsive action of the gaseous medium in a substantially axial direction on the side of a fan blade opposite the suction side.

3. A fan blade as in claim 1 or 2, including a plurality of radially disposed vanes arranged in planes parallel to the axis of the blade.

4. A fan blade as in claim 3, wherein the said vanes are mounted upon a plate

having an annular projection or depression of substantially V-shape in cross section.

5. A fan blade as in claim 3 or 4, wherein the said vanes have curved projecting portions at one of their ends.

6. A fan blade as in claim 2 and 3 or 4, wherein the said vanes have projecting portions at each of their ends curved on opposite directions.

7. A fan blade as in any of the preceding claims 3 to 6, wherein the said vanes have curved edges.

8. A fan blade as in claim 1, having a plurality of vanes substantially of the configuration shown in Figures 4, 5, 6 or 7 of the accompanying drawings.

9. A fan blade as in claim 2, having a plurality of vanes substantially of the configuration shown in Figures 10, 11, 12 or 13 of the accompanying drawings.

10. Ventilating apparatus as in claim 1, wherein the outlet side of the apparatus is closed by a casing the outlet from which is protected by louvres to prevent ingress of water.

11. Ventilating apparatus as in claim 2, wherein the outlet side of the apparatus is enclosed by an apertured casing having a series of stationary blades for the purpose specified.

12. Ventilating apparatus as in claim 11, wherein the said stationary blades have substantially the configuration shown in Figures 14, 15, 16 or 17.

13. Ventilating apparatus as in claim 2, 11 or 12, wherein the apparatus is provided with a substantially conical shaped deflector plate.

14. Ventilating apparatus substantially as described or as shown in Figures 1 to 7 of the accompanying drawings.

15. A fan blade for ventilating apparatus substantially as described or as shown in Figures 3 to 7 of the accompanying drawings.

16. Ventilating apparatus substantially as shown or as described in Figures 9 to 17 of the accompanying drawings.

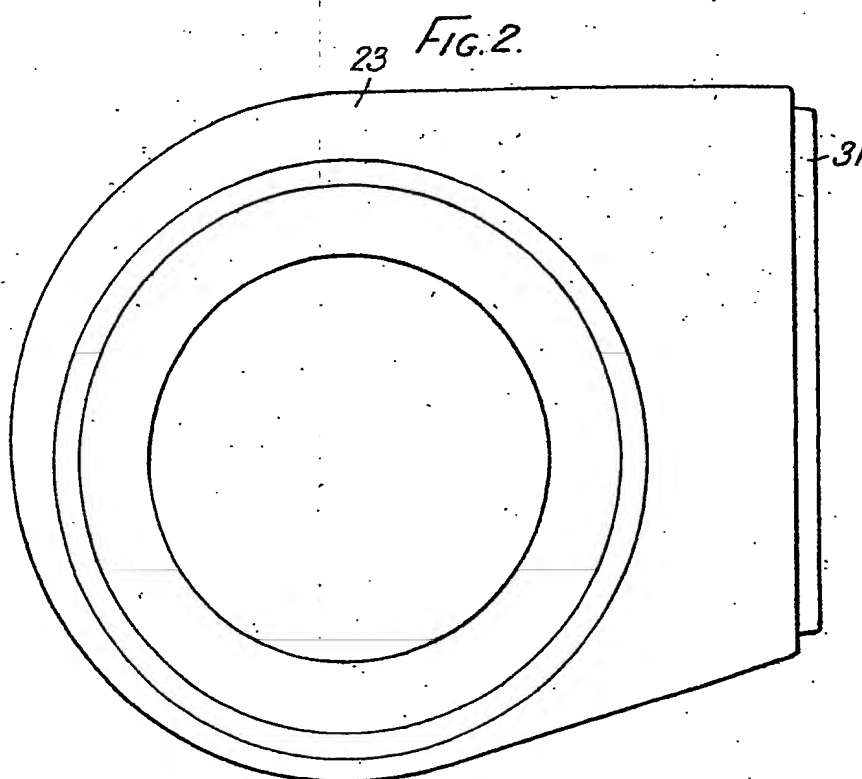
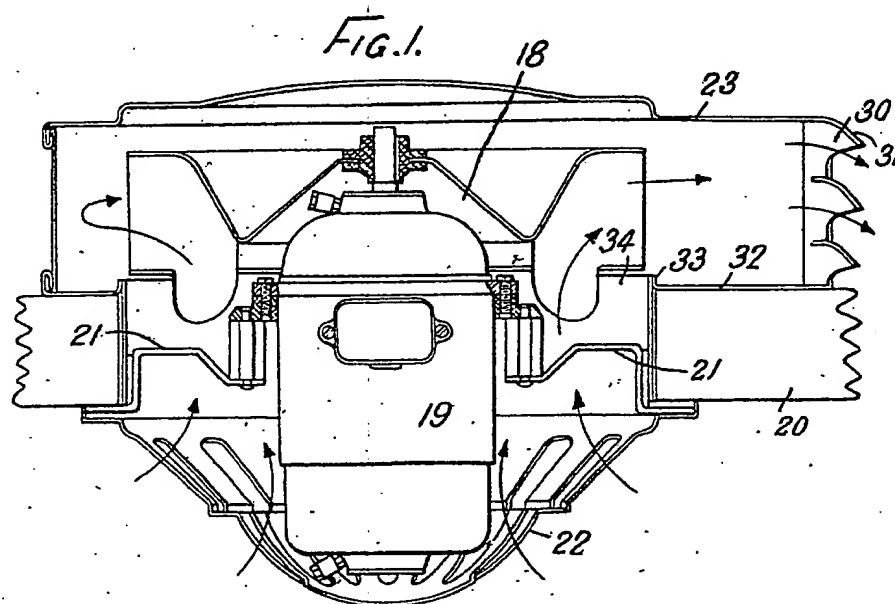
17. A fan blade for ventilating apparatus substantially as described or as shown in Figures 10 to 13 of the accompanying drawings.

Dated this 10th day of February, 1933.

Sgd. HASELTINE, LAKE & Co.,  
28, Southampton Buildings, London,  
England, and  
19—25, West 44th Street, New York,  
U.S.A.,

Agents for the Applicants.

## 419,440 COMPLETE SPECIFICATION



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FIG. 3

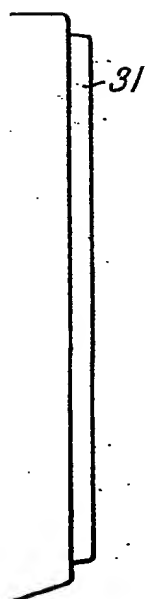
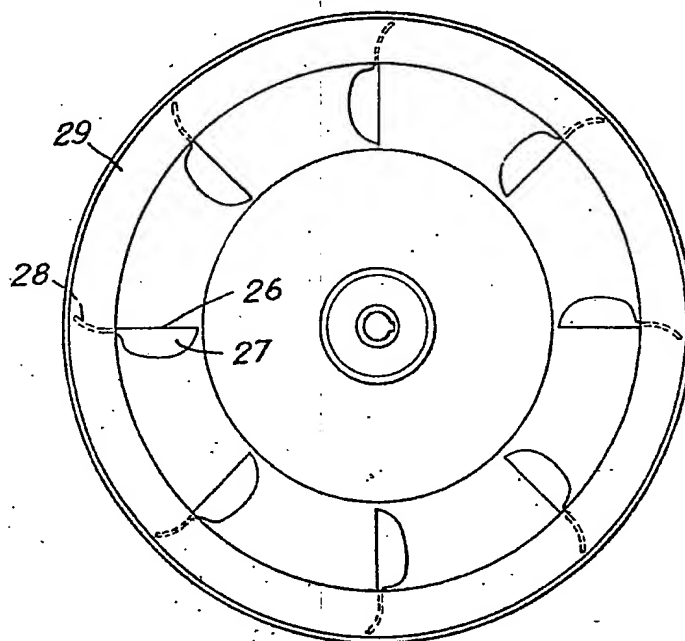


FIG. 4

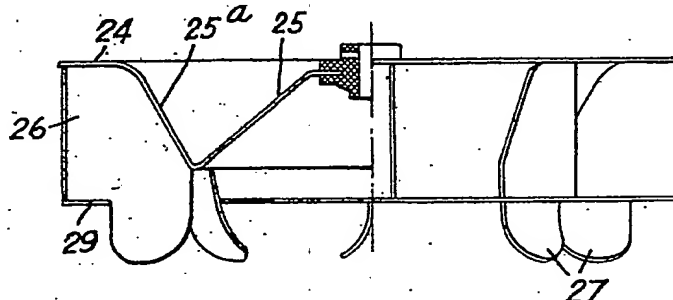


FIG. 5

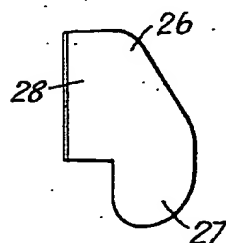
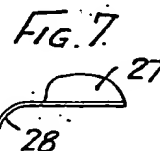
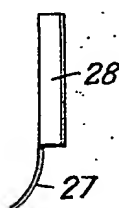


FIG. 6



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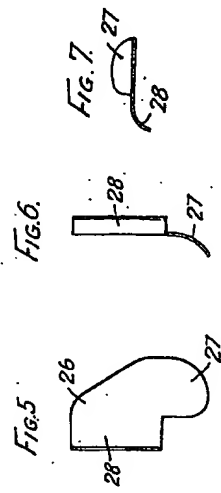
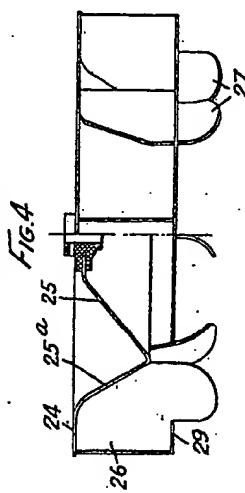
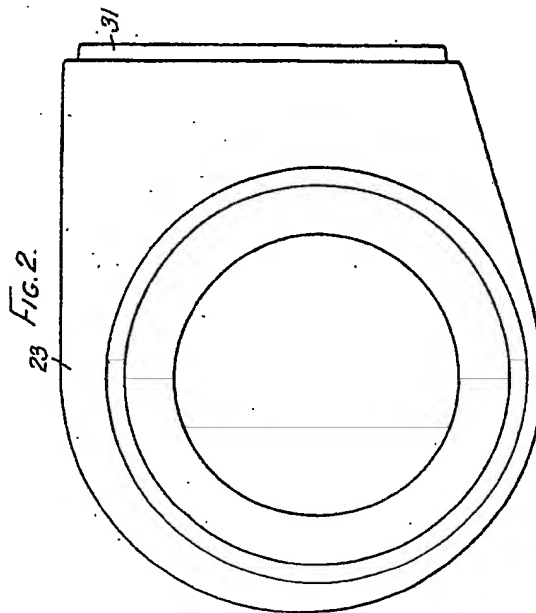
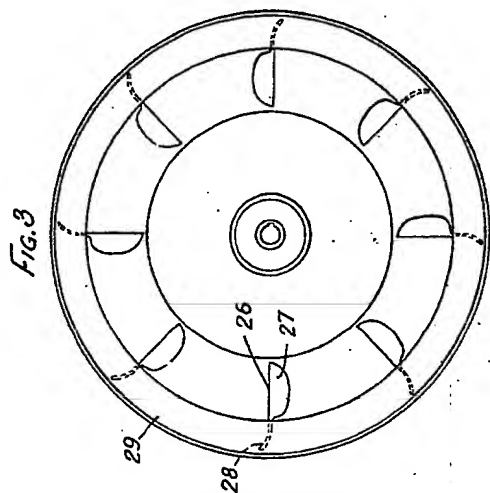
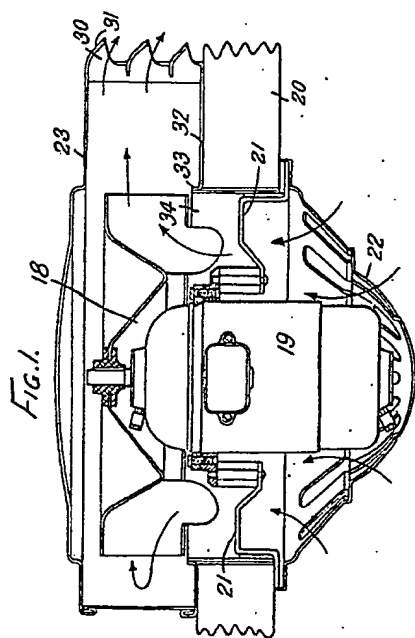
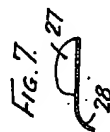
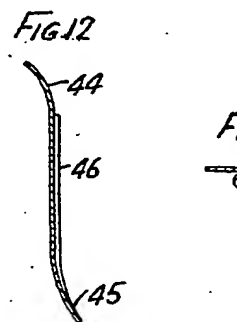
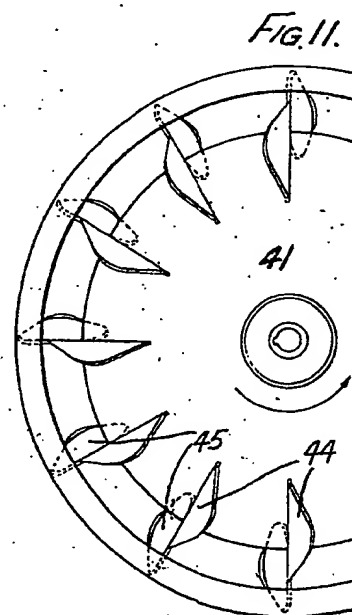
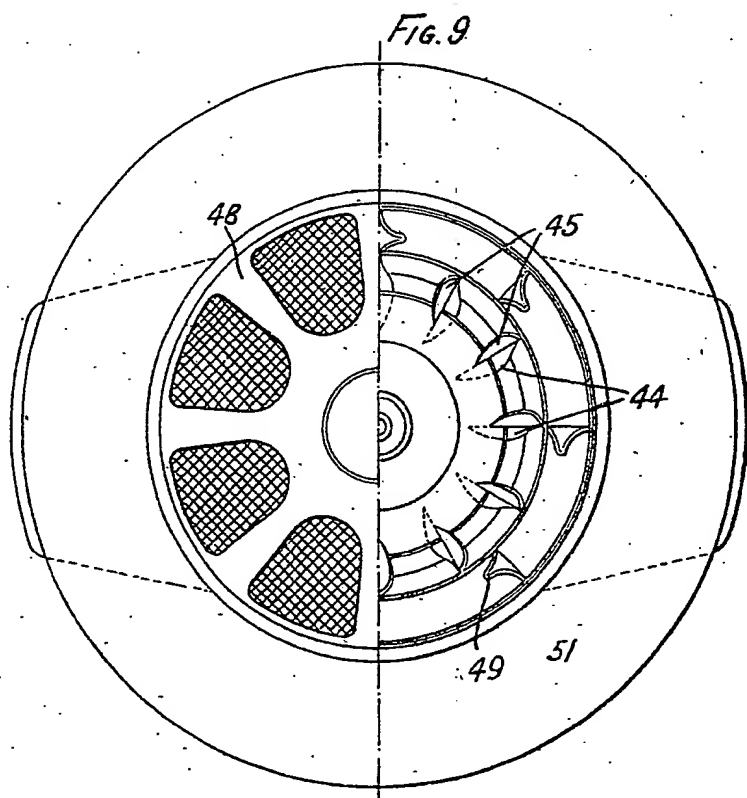
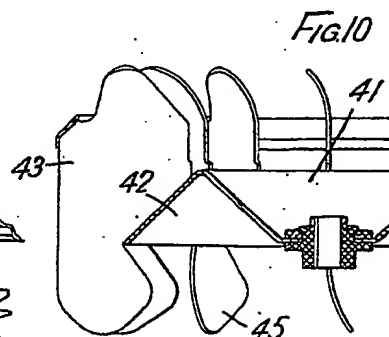
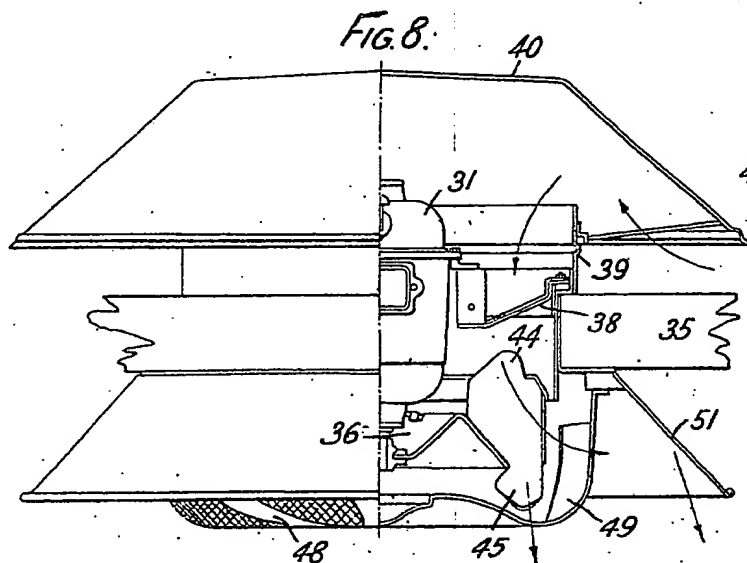


FIG. 6.

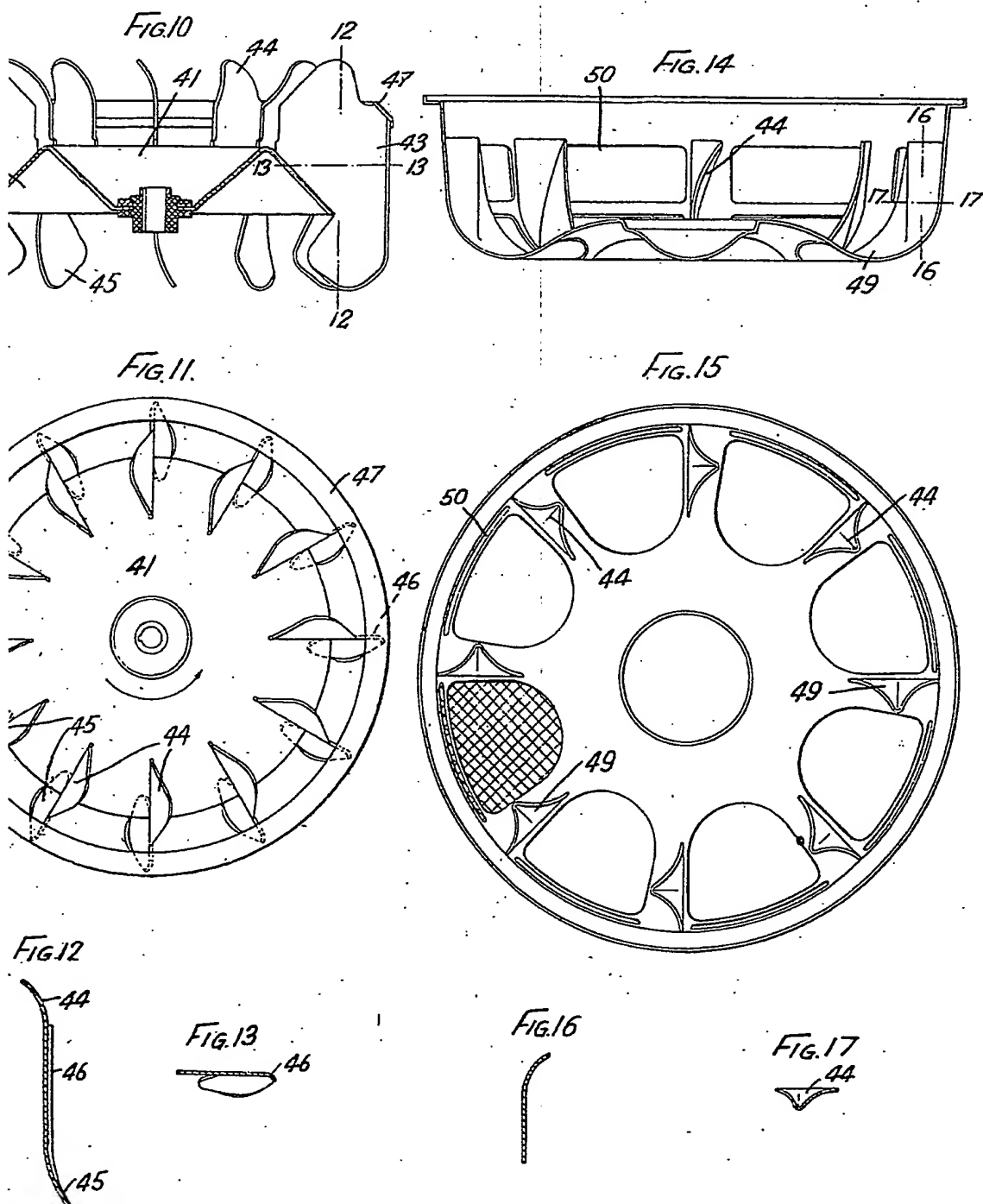


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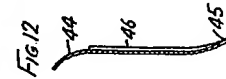
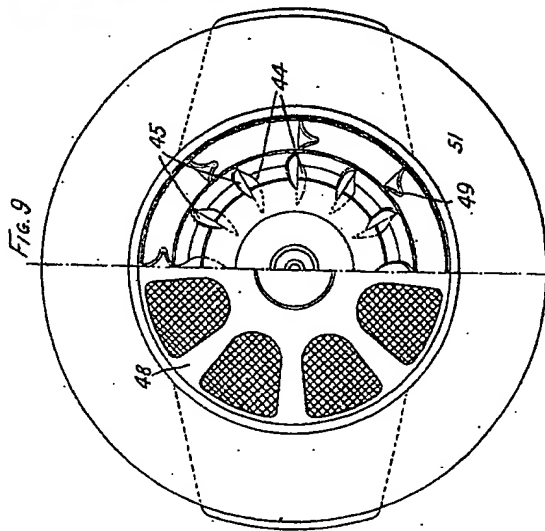
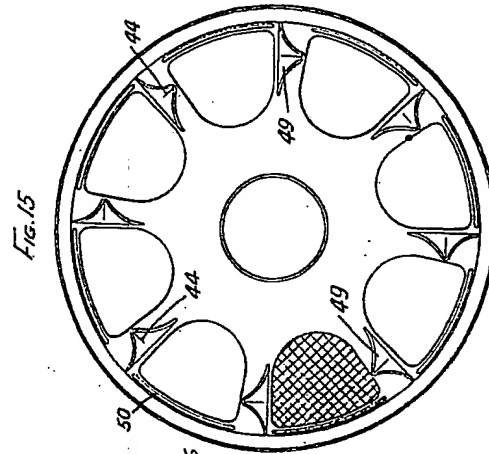
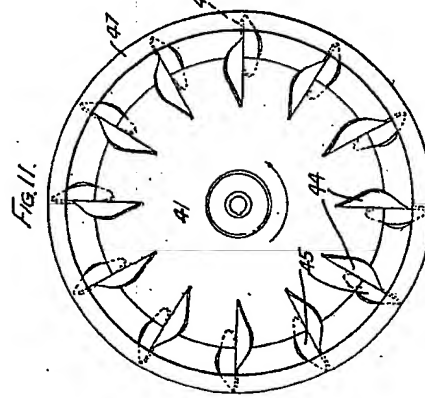
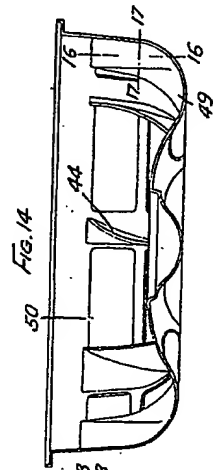
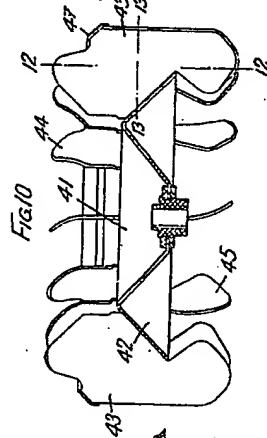
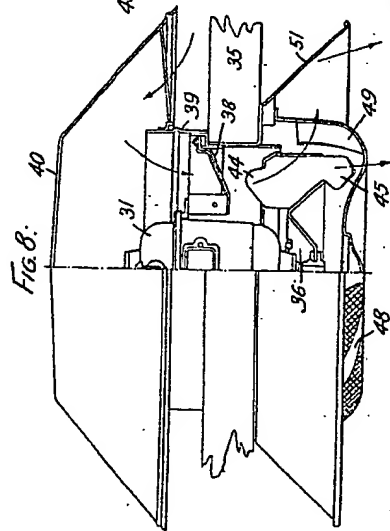


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2 SHEETS  
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